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CHEMICAL EFFECTS

Metabolomic and biochemical disorders reveal the toxicity of environmental microplastics and benzo[a]pyrene in the marine polychaete *Hediste diversicolor*

2024-08-02

Recently, the abundance of environmental microplastics (MPs) has become a global paramount concern. Besides the danger of MPs for biota due to their tiny size, these minute particles may act as vectors of other pollutants. This study focused on evaluating the toxicity of environmentally relevant concentrations of MPs (10 and 50 mg/kg sediment) and benzo[a]pyrene (B[a]P, 1 µg/kg sediment), alone and in mixture, for 3 and 7 days in marine polychaete *Hediste diversicolor*, selected as a benthic bioindicator model. The exposure period was sufficient to confirm the bioaccumulation of both contaminants in seaworms, as well as the potential capacity of plastic particles to adsorb and vehiculate the B[a]P. Interestingly, increase of acidic mucus production was observed in seaworm tissues, indicative of a defense response. The activation of oxidative system pathways was demonstrated as a strategy to prevent lipid peroxidation. Furthermore, the comprehensive Nuclear Magnetic Resonance (NMR)-based metabolomics revealed significant disorders in amino acids metabolism, osmoregulatory process, energetic components, and oxidative stress related elements. Overall, these findings proved the possible synergic harmful effect of MPs and B[a]P even in small concentrations, which increases the concern about their long-term presence in marine ecosystems, and consequently their transfer and repercussions on marine fauna.

Authors: Siwar Abouda, Mariachiara Galati, Gea Oliveri Conti, Tiziana Cappello, Mohamed Rida Abelouah, Ilef Romdhani, Aicha Ait Alla, Margherita Ferrante, Maria Maisano, Mohamed Banni

Full Source: Journal of hazardous materials 2024 Aug 2:477:135404. doi: 10.1016/j.jhazmat.2024.135404.

Bisphenol mixtures, metal mixtures and type 2 diabetes mellitus: Insights from metabolite profiling

2024-07-30

Background: Little is known about the combined effect of bisphenol mixtures and metal mixtures on type 2 diabetes mellitus (T2DM) risk, and the mediating roles of metabolites.

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Methods: The study included 606 pairs of T2DM cases and controls matched by age and sex, and information of participants was collected through questionnaires and laboratory tests. Serum bisphenol and plasma metal concentrations were measured using ultra-performance liquid chromatography-mass spectrometry (UPLC-MS/MS) and inductively coupled plasma-mass spectrometry (ICP-MS), respectively. Widely targeted metabolomics was employed to obtain the serum metabolomic profiles. Conditional logistic regression models were used to assess the single associations of bisphenols and metals with T2DM risk after multivariable adjustment. Additionally, the joint effects of bisphenol mixtures and metal mixtures were examined using quantile-based g-computation (QG-C) models. Furthermore, differential metabolites associated with T2DM were identified, and mediation analyses were performed to explore the role of metabolites in the associations of bisphenols and metals with T2DM risk. Results: The results showed bisphenol mixtures were associated with an increased T2DM risk, with bisphenol A (BPA) identified as the primary contributor. While the association between metal mixtures and T2DM remained inconclusive, cobalt (Co), iron (Fe), and zinc (Zn) showed the highest weight indices for T2DM risk. A total of 154 differential metabolites were screened between the T2DM cases and controls. Mediation analyses indicated that 9 metabolites mediated the association between BPA and T2DM, while L-valine mediated the association between Zn and T2DM risk. Conclusions: The study indicated that BPA, Co, Fe, and Zn were the primary contributors to increased T2DM risk, and metabolites played a mediating role in the associations of BPA and Zn with the risk of T2DM. Our findings contribute to a better understanding of the mechanisms underlying the associations of bisphenols and metals with T2DM.

Authors: Ze Yang, Hongbo Liu, Jiemin Wei, Ruifang Liu, Jingyun Zhang, Meiqing Sun, Changkun Shen, Jian Liu, Kun Men, Yu Chen, Xueli Yang, Pei Yu, Liming Chen, Nai-Jun Tang

Full Source: Environment international 2024 Jul 30:190:108921. doi: 10.1016/j.envint.2024.108921.

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ENVIRONMENTAL RESEARCH

Public drinking water contaminant estimates for birth cohorts in the Environmental Influences on Child Health Outcomes (ECHO) Cohort

2024-08-04

Background: The United States Environmental Protection Agency (USEPA) regulates over 80 contaminants in community water systems (CWS), including those relevant to infant health outcomes. Multi-cohort analyses of the association between measured prenatal public water contaminant concentrations and infant health outcomes are sparse in the US.

Objective: Our objectives were to (1) develop Zip Code Tabulation Area (ZCTA)-level CWS contaminant concentrations for participants in the Environmental Influences on Child Health Outcomes (ECHO) Cohort and (2) evaluate regional, seasonal, and sociodemographic inequities in contaminant concentrations at the ZCTA-level. The ECHO Cohort harmonizes data from over 69 extant pregnancy and pediatric cohorts across the US.

Methods: We used CWS estimates derived from the USEPA's Six-Year Review 3 (2006-2011) to develop population-weighted, average concentrations for 10 contaminants across 7640 ZCTAs relevant to the ECHO Cohort. We evaluated contaminant distributions, exceedances of regulatory thresholds, and geometric mean ratios (with corresponding percent changes) associated with ZCTA sociodemographic characteristics via spatial lag linear regression models.

Results: We observed significant regional variability in contaminant concentrations across the US. ZCTAs were most likely to exceed the maximum contaminant level for arsenic ($n = 100$, 1.4%) and the health-protective threshold for total trihalomethanes ($n = 3584$, 64.0%). A 10% higher proportion of residents who were American Indian/Alaskan Native and Hispanic/Latino was associated with higher arsenic (11%, 95% CI: 7%, 15%; and 2%, 95% CI: 0%, 3%, respectively) and uranium (15%, 95% CI: 10%, 21%; and 9%, 95% CI: 6%, 12%, respectively) concentrations.

Impact: Nationwide epidemiologic analyses evaluating the association between US community water system contaminant concentration estimates and associated adverse birth outcomes in cohort studies are sparse because public water contaminant concentration estimates that can be readily linked to participant addresses are not available. We developed Zip Code Tabulation Area (ZCTA)-level CWS contaminant concentrations that can be linked to participants in the Environmental

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Influences on Child Health Outcomes (ECHO) Cohort and evaluated regional, seasonal, and sociodemographic inequities in contaminant concentrations for these ZCTAs. Future epidemiologic studies can leverage these CWS exposure estimates in the ECHO Cohort to evaluate associations with relevant infant outcomes.

Authors: Tessa R Bloomquist, Maya Spaur, Ilan Cerna-Turoff, Amii M Kress, Mohamad Burjak, Allison Kupsco, Joan A Casey, Julie B Herbstman, Anne E Nigra

Full Source: Journal of exposure science & environmental epidemiology 2024 Aug 4. doi: 10.1038/s41370-024-00699-2.

Prospects and challenges of nanopesticides in advancing pest management for sustainable agricultural and environmental service

2024-08-02

The expanding global population and the use of conventional agrochemical pesticides have led to the loss of crop yield and food shortages. Excessive pesticide used in agriculture risks life forms by contaminating soil and water resources, necessitating the use of nano agrochemicals. This article focuses on synthesis moiety and use of nanopesticides for enhanced stability, controlled release mechanisms, improved efficacy, and reduced pesticide residue levels. The current literature survey offered regulatory frameworks for commercial deployment of nanopesticides and evaluated societal and environmental impacts. Various physicochemical and biological processes, especially microorganisms and advanced oxidation techniques are important in treating pesticide residues through degradation mechanisms. Agricultural waste could be converted into nanofibers for sustainable composites production, new nanocatalysts, such as N-doped TiO₂ and bimetallic nanoparticles for advancing pesticide degradation. Microbial and enzyme methods have been listed as emerging nanobiotechnology tools in achieving a significant reduction of chlorpyrifos and dimethomorph for the management of pesticide residues in agriculture. Moreover, cutting-edge biotechnological alternatives to conventional pesticides are advocated for promoting a transition towards more sustainable pest control methodologies. Application of nanopesticides could be critical in addressing environmental concern due to its increased mobility, prolonged persistence and ecosystem toxicity. Green synthesis of nanopesticides offers solutions to environmental risks associated and using genetic engineering techniques may induce pest and disease resistance for agricultural sustainability. Production of nanopesticides from

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biological sources is necessary to develop and implement comprehensive strategies to uphold agricultural productivity while safeguarding environmental integrity.

Authors: Rida Zainab, Maria Hasnain, Faraz Ali, Zainul Abideen, Zamin Shaheed Siddiqui, Farrukh Jamil, Murid Hussain, Young-Kwon Park
Full Source: Environmental research 2024 Aug 2:119722. doi: 10.1016/j.envres.2024.119722.

Rapid effects of plastic pollution on coastal sediment metabolism in nature

2024-08-02

While extensive research has explored the effects of plastic pollution, ecosystem responses remain poorly quantified, especially in field experiments. In this study, we investigated the impact of polyester pollution, a prevalent plastic type, on coastal sediment ecosystem function. Strips of polyester netting were buried into intertidal sediments, and effects on sediment oxygen consumption and polyester additive concentrations were monitored over 72-days. Our results revealed a rapid reduction in the magnitude and variability of sediment oxygen consumption, a crucial ecosystem process, potentially attributed to the loss of the additive di(2-ethylhexyl) phthalate (DEHP) from the polyester material. DEHP concentrations declined by 89% within the first seven days of deployment. However, effects on SOC dissipated after 22 days, indicating a short-term impact and a quick recovery by the ecosystem. Our study provides critical insights into the immediate consequences of plastic pollution on ecosystem metabolism in coastal sediments, contributing to a nuanced understanding of the temporal variation of plastic pollution's multifaceted impacts. Additionally, our research sheds light on the urgent need for comprehensive mitigation strategies to preserve marine ecosystem functionality from plastic pollution impacts.

Authors: Samantha M Ladewig, Ines Bartl, Joel D Rindelaub, Simon F Thrush

Full Source: Scientific reports 2024 Aug 2;14(1):17963. doi: 10.1038/s41598-024-68766-0.

Ecosystem risk-based prioritization of micropollutants in wastewater treatment plant effluents across China

2024-07-28

Identifying priority pollutants in wastewater treatment plant (WWTP) effluents is crucial for optimizing monitoring efforts, improving

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regulations, and developing targeted mitigation strategies. Despite the presence of numerous trace organic pollutants in WWTP effluents, a comprehensive prioritization scheme is lacking, hindering effective control. This study screened 216 micropollutants, including pharmaceuticals, pesticides, and industrial chemicals, which had been detected in effluents from 46 WWTPs across China. A multi-criteria prioritization method was developed, considering exposure potential based on median concentrations and detection frequencies, as well as hazard potential determined by persistence, bioaccumulation, in vitro toxicity, and in vivo toxicity. Pollutants with low exposure or hazard potential were filtered out, and a priority index was calculated to rank the remaining 59 substances. The top 15 priority pollutants included regulated persistent organic pollutants like perfluorooctanoic acid and their alternatives such as perfluorobutane sulfonate, pesticide transformation products, and emerging contaminants such as bisphenol A, which are not currently regulated in WWTP effluents. This study provides a systematic approach to identify priority pollutants and generates a guiding framework for monitoring, regulation, and control of both well-recognized and overlooked contaminants in WWTP effluents.

Authors: Jianchao Liu, Tian Ouyang, Guanghua Lu, Ming Li, Yiping Li, Jun Hou, Chao He, Peng Gao

Full Source: Water research 2024 Jul 28:263:122168. doi: 10.1016/j.watres.2024.122168.

PHARMACEUTICAL/TOXICOLOGY

Effects of pesticide exposure on the expression of selected genes in normal and cancer samples: Identification of predictive biomarkers for risk assessment

2024-08-05

Pesticides pivotal in controlling pests, can represent a threat for human health. Regulatory agencies constantly monitor their harmful effects, regulating their use. Several studies support a positive association between long-term exposure to pesticides and chronic pathologies, such as cancer. Geno-toxicological biomonitoring has proven to be valuable to assess genetic risks associated with exposure to pesticides, representing a promising tool to improve preventive measures and identify workers at higher risk. In this study, a differential gene expression analysis of 70 candidate genes deregulated upon pesticide exposure, was performed in 10 GEO human gene expression DataSets. It was found that six genes

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(PMAIP1, GCLM, CD36, SQSTM1, ABCC3, NR4A2) had significant AUC predictive values. Also, CD36 was upregulated in non-transformed cell samples and healthy workers, but downregulated in cancer cells. Further validation in larger groups of workers will corroborate the importance of the identified candidates as biomarkers of exposure/effect.

Authors: Sebastiano Italia, Silvia Vivarelli, Michele Teodoro, Chiara Costa, Concettina Fenga, Federica Giambò
Full Source: Environmental toxicology and pharmacology 2024 Aug 5:110:104524. doi: 10.1016/j.etap.2024.104524.

Innovative techniques for combating a common enemy forever chemical: A comprehensive approach to mitigating per- and polyfluoroalkyl substances (PFAS) contamination

2024-08-03

The pervasive presence of per and polyfluoroalkyl substances (PFAS), commonly referred to as “forever chemicals,” in water systems poses a significant threat to both the environment and public health. PFAS are persistent organic pollutants that are incredibly resistant to degradation and have a tendency to accumulate in the environment, resulting in long-term contamination issues. This comprehensive review delves into the primary impacts of PFAS on both the environment and human health while also delving into advanced techniques aimed at addressing these concerns. The focus is on exploring the efficacy, practicality, and sustainability of these methods. The review outlines several key methods, such as advanced oxidation processes, novel materials adsorption, bioremediation, membrane filtration, and in-situ chemical oxidation, and evaluates their effectiveness in addressing PFAS contamination. By conducting a comparative analysis of these techniques, the study aims to provide a thorough understanding of current PFAS remediation technologies, as well as offer insights into integrated approaches for managing these persistent pollutants effectively. While acknowledging the high efficiency of adsorption and membrane filtration in reducing persistent organic pollutants due to their relatively low cost, versatility, and wide applicability, the review suggests that the integration of these methods could result in an overall enhancement of removal performance. Additionally, the study emphasizes the need for researcher attention in key

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areas and underscores the necessity of collaboration between researchers, industry, and regulatory authorities to address this complex challenge.

Authors: Ajibola A Bayode, Stephen Sunday Emmanuel, Amos O Akinyemi, Odunayo T Ore, Samson O Akpotu, Daniel T Koko, David E Momodu, Eduardo Alberto López-Maldonado
Full Source: Environmental research 2024 Aug 3:261:119719. doi: 10.1016/j.envres.2024.119719~rOCCUPATIONAL

Cross-sectional and longitudinal associations of PAHs exposure with serum uric acid and hyperuricemia among Chinese urban residents: the potential role of oxidative damage

2024-08-02

A few studies found polycyclic aromatic hydrocarbons (PAHs) were associated with serum uric acid (SUA) or hyperuricemia (HUA). However, the longitudinal study is vacant, and the underlying mechanisms remain unclear. We aimed to assess the cross-sectional and longitudinal associations of urinary PAHs metabolites with SUA levels and HUA risk, and explore the mediating effects of oxidative stress and inflammation. 10 urinary mono-hydroxylated PAHs metabolites and SUA levels were measured among 4047 Chinese urban residents at baseline and 1496 individuals at 6-year follow-up. Biomarkers of oxidative damage and inflammation in urine/plasma were determined at baseline. We adopted generalized linear mixed models and logistic regression to assess the associations of PAHs metabolites with SUA and HUA, weighted quantile sum regression and adaptive elastic net regression to evaluate the overall effects of multi-PAHs mixture, and mediation analysis to estimate the mediating roles of the biomarkers. In the cross-sectional study, each 1-unit increase in the ln-transformed values of 2-OHNa, 2-OHFlu, 4-OHPh, 9-OHPh, 3-OHPh, 2-OHPh, Σ OHNa, Σ OHPH, and Σ OHPAHs was associated with a 4.10-, 3.90-, 6.42-, 7.33-, 4.85-, 5.43-, 4.47-, 7.67-, and 5.22- μ mol/L increase in SUA, respectively. Meanwhile, each 1-unit increase in the ln-transformed values of 1-OHNa, 2-OHNa, 4-OHPh, 9-OHPh, 3-OHPh, 2-OHPh, Σ OHNa, Σ OHPH, and Σ OHPAHs was associated with a 17, 14, 15, 22, 14, 19, 18, 27, and 21% increment in HUA risk, respectively. After 6 years, individuals with persistent high level of 9-OHPh had a 12.5 μ mol/L increase in SUA compared with those with persistent low level. The overall effects of multi-PAHs mixture on SUA and HUA remain positive. 8-hydroxydeoxyguanosine mediated the associations of PAHs metabolites with SUA and HUA, and the mediated proportion ranged from 5.39% to 15.34%. PAHs exposure was associated with the elevated SUA levels and increased

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HUA risk, and oxidative DNA damage may be one of the underlying mechanisms.

Authors: Xuejie Ding, Yang Liu, Shuhui Wan, Yueru Yang, Ruyi Liang, Shijie Yang, Jiak Zhang, Xiuyu Cao, Min Zhou, Weihong Chen

Full Source: Environmental pollution (Barking, Essex: 1987) 2024 Aug 2:124664. doi: 10.1016/j.envpol.2024.124664.

Female teleworkers with pain have the highest presenteeism, where its primary contributing variable was not those of musculoskeletal disability

2024-08-05

Presenteeism, among desk workers with pain can be affected by musculoskeletal disabilities (MSDs), working styles, and gender. In this study, teleworkers were defined as those who teleworked >70% of the time at home, while others were defined as non-full teleworkers. This study aimed to (1) compare the magnitude of presenteeism among four groups: male and female teleworkers with pain and male and female non-full teleworkers with pain, and (2) create a regression model of presenteeism with 66 independent biopsychosocial variables for each group. Data were collected through an anonymous online survey. Presenteeism was evaluated using the work functioning impairment scale. The 66 independent biopsychosocial variables included four disability measures, namely, stiff neck/shoulders, low back pain, and upper or lower limb problems, along with other factors relevant to presenteeism in previous studies, such as age, body mass index, comorbidities, work-related variables, pain catastrophizing, and various psychological distress measures. Data from 1068 male non-full teleworkers, 1,043 female non-full teleworkers, 282 male teleworkers, and 307 female teleworkers were analyzed. Presenteeism was the highest among female teleworkers with pain. Furthermore, in all models, overall psychological distress, rather than the four MSD measures, was the primary contributing factor for presenteeism.

Authors: Hiroshi Takasaki

Full Source: Industrial health 2024 Aug 5. doi: 10.2486/indhealth.2024-0068.

Presenteeism, among desk workers with pain can be affected by musculoskeletal disabilities (MSDs), working styles, and gender.